



DEPARTMENT OF ENERGY OFFICE OF FOSSIL ENERGY FEDERAL ENERGY TECHNOLOGY CENTER

PS014.0697

## HIGH-PERFORMANCE POWER SYSTEM FOR THE 21ST CENTURY

## **Project Description**

United Technologies Research Center is leading a team of companies in developing an innovative, clean, and efficient coal-fired power plant for the 21st century. The High Performance Power System (HIPPS) is based on an indirectly fired cycle that uses a high-efficiency gas turbine. The combustion process heats a "working fluid" (air) that drives the turbine.

The HIPPS will have a thermal efficiency of 47% or greater—today's coal-fired power plants range from 33% to 35%. The system can use a clean fuel, such as natural gas, to further increase efficiency. Higher efficiency significantly reduces greenhouse gases, since less fuel is burned to produce power, and reduces consumers' electricity

Additionally, the system can potentially reduce air emissions levels to one-tenth the level today's Federal standards allow, while creating marketable by-products in place of solid waste (saving disposal expenses).

During Phase I, which has been completed, the team produced a conceptual design after analyzing various alternatives to determine technical risk and economic feasibility. Key activities in Phase II will be to generate experimental data for subsystems, conduct engineering and economic analyses, and design the prototype plant. At the end of Phase II, one of the two teams in the HIPPS program will be selected to proceed to Phase III, construction and operation of a prototype plant.

### **Program Goal**

The U.S. Department of Energy's strategic plan aims to reduce any adverse environmental impacts associated with energy production, delivery, and use. The HIPPS program's objective is to achieve significant increases in thermodynamic efficiency of electric-power generation. Through increased efficiency, all airborne emissions can be decreased, including carbon dioxide emissions. Moreover, higher efficiency yields environmental benefits throughout the entire fuel cycle, including coal mining and transportation, reducing solid waste, water requirements, and thermal loadings to bodies of water.

#### PRIMARY PROJECT PARTNERS

**United Technologies** Research Center East Hartford, CT

#### **MAIN SITE**

East Hartford, CT

### **TOTAL ESTIMATED COST**

\$42,544,000

#### **COST SHARING**

DOE \$35,058,000

Non-DOE \$7,486,000

## HIGH-PERFORMANCE POWER SYSTEM FOR THE 21ST CENTURY

#### **CONTACT POINTS**

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## **Project Partners**

## ABB-COMBUSTION ENGINEERING SYSTEMS

Windsor, CT (subsystem testing, commercialization)

#### **BECHTEL**

San Francisco, CA (commercial plant design, balance-of-plant)

## ENERGY AND ENVIRONMENTAL RESEARCH CENTER

Grand Forks, ND (air heater testing, ash deposit research)

#### FLUOR DANIEL, INC.

Irvine, CA (power island design)

#### KRAFTWORK SYSTEMS

Amston, CT (power systems analysis)

#### PHYSICAL SCIENCES, INC.

Andover, MA (ash management)

## REACTION ENGINEERING INTERNATIONAL

Salt Lake City, UT (combustor design)

# TURBO POWER AND MARINE DIVISION OF PRATT AND WHITNEY

East Hartford, CT (gas turbine design)

## THE UNIVERSITY OF UTAH

Salt Lake City, UT (combustor design)

## **Project Benefits**

The High Performance Power System (HIPPS) is expected to meet the combined goals of higher power-generating efficiency, extremely clean environmental performance, and affordable electricity.

Coal currently supplies more than 56% of the Nation's electric-power needs, and is projected to remain a dominant global source of fuel for electric-power generation well into the 21st century. Early in the next decade, older utility plants will be retired as electricity demand continues to increase. The HIPPS will provide an important option for power companies, enabling them to meet stringent air-quality standards while producing the most affordable electricity possible for consumers.

#### The HIPPS will:

- Increase electric-generating efficiency to 47% or more.
- Lower emissions of sulfur and nitrogen pollutants to less than a tenth of the levels current U.S. new-plant standards allow, and meet or exceed the strictest world standards for overall environmental performance of coal-fired plants.
- Reduce greenhouse gas emissions, specifically carbon dioxide, by as much as 30% in the first commercial plants and, as technology matures, by more than 35% overall.
- Produce electricity at costs at least 10% below those of today's plants.
- Repower existing coal-fired plants, significantly increasing operating efficiency.

### **Cost Profile**

(Dollars in Millions)

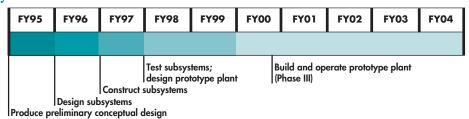
Department of Energy\*

Private Sector

Prior Investment	FY95	FY96	FY97	Future Funds**
\$5.9	\$3.6	\$4.9	\$3.8	\$16.7
_	\$0.9	\$1.2	\$1.0	\$4.4

<sup>\*</sup> Appropriated Funding

### **Key Milestones**



<sup>\*\*</sup> DOE and non-DOE Partners will contribute an additional \$50 million each during Phase III.